Description

Method for making contact between at least one module for wire-free radio standards and at least one application

The present invention relates to a method for making contact between a module for wire-free radio standards and an application, and to a corresponding combination of a module with an application.

Modules for wire-free radio standards, which have complete GSM/GPRS functionality, so-called wireless modules, are being used in increasing numbers in applications, for example in mobile computing systems, in PDAs and in portable and lightweight telematics systems. In this case, wireless modules are subject to specific requirements. Firstly, their physical size should be as small as possible in order that they can be used well and occupy little space. Depending on the application, they should be chosen such that height, width and/or length are/is small and appropriate. By way of example, a small physical height is the critical factor for PDAs. Furthermore, in accordance with their specification, the wireless modules must have adequate transmission power. This is particularly due to the fact that the modules are integrated in an application and the connecting lines that are required cause losses. Furthermore, a long operating period is desirable. The wireless modules should be capable of being installed easily and quickly in the various applications, and should be capable of being replaced easily and quickly by other modules with the same or with an upgraded functionality.

Commercially available wireless modules have until now been connected to an application, for example to a motherboard

of a PDA via plug connectors, such as board-to-board connectors, or via flat ribbon cable connectors. However, this results in a number of disadvantages. The stated connection options consume a large amount of space and are not suitable for miniaturization. Furthermore, the contact is unreliable when using flat ribbon cables. This is due, inter alia, to the desire for further miniaturization and to the reduction which this results in in the distances between the individual lines in the flat ribbon cable. The reduction in the conductor cross sections of the connecting lines which is likewise involved with miniaturization results in a high electrical contact resistance. In addition, inadequate contact between the module and a heat sink results in a high thermal contact resistance. The ground contact between the module and the application is inadequate, owing to the high resistance of the connecting line. An RF (radio-frequency) connection between a module and an application or an antenna is normally made via a plug and socket system or via a soldered coaxial cable. While the first variant is quite costly, the second option (soldering) does not allow thermal effects to be precluded, which can change the behavior of the module.

Since the distance between the contacts on the flat ribbon connector or board-to-board connector is very short, it is difficult to use the contact points as test points while manufacturing the modules. Furthermore, the modules must be manually mounted on an application. Plug insertion, screwing, clamping and soldering processes are normally used for mounting. Owing to this problem on the one hand and the inadequate definition and standardization of interfaces for the customer application on the other hand, a module can be replaced by another module with a different functionality only with major effort. In contrast, it is desirable

to have a technical solution which is optimized and standardized not only for the technical parameters, for example low thermal resistance between the heat source on the module and the heat sink on the application, low electrical resistance for the signal and voltage supply between the module and the application, defined electrical impedance of the RF connections between the module and the application, but also for mounting and adaptation.

One object of the present invention was therefore to provide a method and a corresponding arrangement which allow contacts to be made as functionally, quickly and simply as possible, while saving as much space as possible.

This object is achieved by the method according to the invention as claimed in claim 1 and by a combination of a module with an application according to the invention as claimed in claim 7. Advantageous embodiments are described in the corresponding dependent claims.

According to claim 1, a method is provided for making contact between at least one module for wire-free radio standards and at least one application, with

- contact surfaces being provided on a side of the module which is intended to make contact with the application, and
- contact surfaces which can interact with the contact surfaces of the module being provided on a side of the application which is intended to make contact with the module, and
- a connection being produced between the respective contact surfaces of the module and the application.

In one preferred embodiment of the method according to the invention, a detachable connection is provided

between the respective contact surfaces by means of a mechanical apparatus which allows the

module to be pushed into and out of the application, with the contact surfaces which are opposite one another when the module is in the inserted state forming a detachable connection. By way of example, the mechanical apparatus includes a guide rail in the application, in which the module can be pushed in and out in an interlocking manner. The module can thus be replaced very simply and easily by another module having the same functionality or different functionality. In order to make reliable electrical and thermal contact, mechanical elements such as pins or mechanical springs can advantageously be provided on the application side, pressing against the module contacts with an adequate spring force.

In contrast, in another preferred embodiment of the method according to the invention, a firm connection is provided between the respective contact surfaces. The respective contact surfaces are in this case preferably soldered to one another. A further option is to press the two components together.

In a further preferred embodiment of the method according to the invention, the respective contact surfaces are arranged in the form of a grid or of a specific array.

The contact surfaces are preferably formed by a metallic coating with a low electrical and/or thermal resistance. Typical coatings are copper, aluminum and gold alloys.

The present invention furthermore covers a combination, having a module for wire-free radio standards and having an application, with the module having contact

surfaces on a side which is intended to make contact with the application, and the application having contact surfaces on a side which is intended to make contact with the module, which latter contact surfaces can interact with the contact surfaces of the module and can make contact with them.

In one preferred embodiment of the combination according to the invention, the respective contact surfaces can be detachably connected to one another.

In another preferred embodiment of the combination according to the invention, the respective contact surfaces may, in contrast to this, be permanently connected to one another. In this case, they can preferably be soldered or crimped to one another.

Furthermore, the respective contact surfaces are preferably arranged in the form of a grid.

Owing to the very small amount of space which is consumed for making contact with the module, the present invention allows a high degree of miniaturization to be achieved. Furthermore, reliable contact is ensured particularly when soldering the respective contact surfaces to one another. Only a very low electrical and thermal contact resistance occurs in this case. In this case, the material system copper/solder (tin/lead system)/copper is used as the electrical/thermal conductor. This results in a very good ground contact between the module and the application. Furthermore, according to the invention, it is possible to produce a direct contact between the RF connection and an application while, until now, expensive RF connectors have been required for this purpose. Test points can easily be provided. This results in good contact and in simple handling during manufacture.

The invention provides the capability for automated mounting of the modules on the corresponding applications.

Further advantages will be indicated with reference to the following figures, in which:

Figure 1 shows a schematic illustration of the rear face of a module of one embodiment of a combination according to the invention, and

Figure 2 shows a schematic illustration of one embodiment of a combination according to the invention, having a module and an application, in which the module and the application can be detachably connected to one another.

Figure 1 shows the rear face 1 of a module of a combination according to the invention, having a module and an application. The arrangement here has a connecting point 2 for a power amplifier. Furthermore, at least one ground contact 3 and at least one connecting point 4 are provided for a voltage supply. The smaller, rectangular contact surfaces represent interfaces 5 for an application with which contact is intended to be made. Alternatively, test points 6 for manufacture and test points 7 for development can be provided under the smaller rectangular contact surfaces. Furthermore, an RF contact point 8 can explicitly be provided.

Figure 2 shows a mechanical apparatus for holding a module 2 in an application 1, as well as a module 2 which can be pushed into and out of this apparatus or the application 1. The mechanical apparatus includes, by way of example, a guide rail in the application 1, in which the module 2 can be displaced in an interlocking manner. When the module 2

is in the pushed-in state, the contact surfaces of the module 2 and the contact surfaces of the application 1 are opposite one another.